

Geospatial Data Coordination Implementation Guide

April 2005

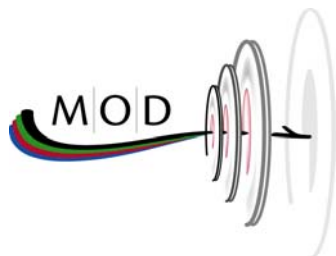


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1. Introduction

1.1. Geospatial Data Coordination Policy

The Department of Homeland Security's Federal Emergency Management Agency (FEMA) Geospatial Data Coordination Policy establishes the principles for coordinating, communicating, documenting, and reporting existing and proposed geospatial data collected, produced, or manipulated under the National Flood Insurance Program within the jurisdiction of FEMA.

The goals of the Policy document are to help ensure that the Multi-Hazard Flood Map Modernization Program will:

- protect its investments in geospatial data by requiring data to be documented, comply to standards and be easily accessible to the general public;
- maximize the use of partnerships, including Federal, State, and local partners, for the acquisition and production of geospatial data;
- minimize duplicative requests from Federal agencies to State and local data stewards;
- recognize the value of existing coordination efforts at the State and local levels; and
- comply with all Federal requirements for coordination and reporting of geospatial activities.

1.2. Geospatial Data Coordination Implementation Guide

To support the goals of the Policy, data coordination procedures must be established to provide guidance to the Digital Flood Insurance Rate Map (DFIRM) production process for FEMA and its stakeholders. This Data Coordination Implementation Guide will provide step-by-step guidance on how to coordinate within Federal, State, and local governments, document and report geospatial collection, and produce flood study projects.

1.3. Versioning

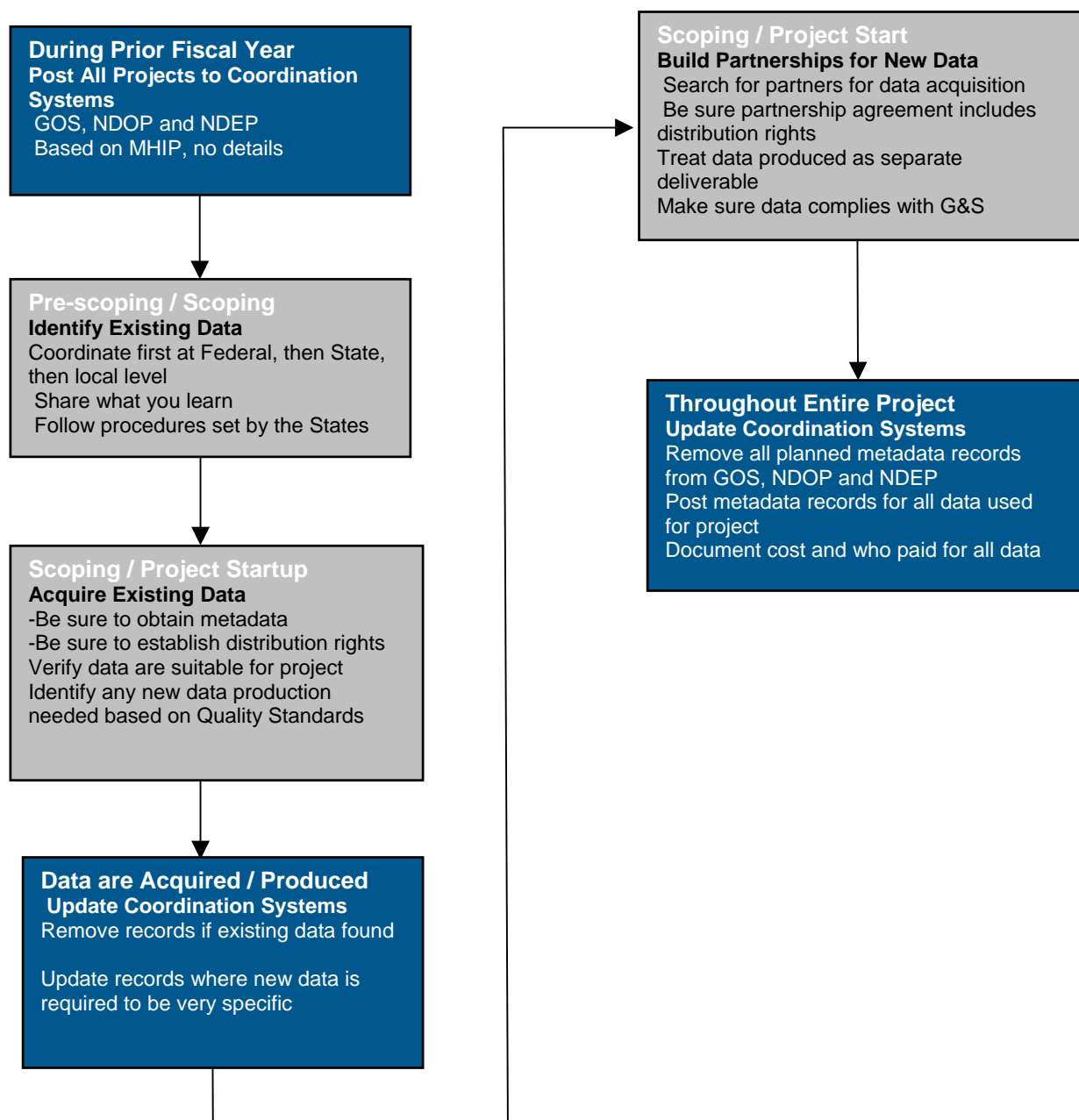
This is Version 1.0 of the Implementation Guide. Subsequent versions will be released in conjunction with the Multi-hazard Information Platform (MIP) as some of the processes documented herein become more automated.

This document references FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners dated April 2003 (hereby referred to as G&S). Although some sections of this document summarize procedures contained in the G&S, it is not meant to be used as a substitute. The G&S should be used as the comprehensive reference for mapping specifications.

1.4. Organization

This document is authored and maintained by the Geospatial Data Coordination and Standardization (GDSCS) team, based in the Alexandria Office. Refer to Appendix A for contact information.

Process Flowchart



2. Identifying Existing Data

Chapter 1 focuses on identifying digital data that are potentially suitable for use by FEMA mapping partners in accomplishing tasks related to Map Modernization. Avoiding duplication of existing data and utilizing the best available datasets are critical to managing our production budget and demonstrating proper stewardship of the funds expended. The steps outlined in this chapter shall be completed during the Pre-Scoping and Scoping phase of a Flood Insurance Study.

STEP 1 - Identify What Features Are Required

Features that need to be identified are classified into two categories: base map features and terrain data. There are a number of specific feature types required for flood maps. These types are identified in Appendix K: Format and Specifications for Flood Insurance Rate Maps of the G&S. The key decisions that must be made at the outset of the project will be the primary source for showing the locations of roads and what accuracy of terrain data is required for the study. Both of these issues should be discussed in detail at the scoping meeting.

For road locations, the data must have horizontal accuracy equal to or better than the United States Geological Survey (USGS)/National Digital Orthophoto Program (NDOP) 1-meter Digital Orthophoto Quadrangles (DOQs). Refer to Chapter 3 for details. For terrain data, the project lead must determine the required accuracy based on the risk for each stream reach. Terrain data are critical for flood studies; all sources should be explored. The terrain section of the scoping tool shall be completed for all studies. Because of the importance of these data sets for FEMA, all projects should coordinate throughout with the NDOP and National Digital Elevation Program (NDEP) on imagery and topographic data sets, respectively.

STEP 2 - Identify Available Datasets

Data sources that will meet our program needs may exist at the Federal, State, and local levels. Existing data sources should be investigated and identified prior to any new data acquisition as outlined in Chapter 4. Initiate your direct contacts at the Federal level, then go on to identify State Data holdings and data holdings at the local level. This top down approach should be followed unless the State specifically prefers a different approach. All projects in a given State should be addressed with the State contact simultaneously, when possible, to eliminate redundant contact.

The following are steps that should be taken by the lead in the Pre-scoping and Scoping processes for the Federal and State data assessments. These steps should be followed in the order presented here.

Research Data Inventories

Using the results of the National States Geographic Information Council (NSGIC) State survey and the template provided by the GDCS, each NSP Regional Management Center (RMC) should have a state specific Geospatial Coordination Procedure for each State. The coordination procedures should indicate the features required for that State (e.g., Are section/township/range or extra-territorial jurisdictions applicable?); what preferred data sources the State has identified; and what data catalogs the State has identified. Review these resources to determine the availability of data required.

The GDCS team will identify major Federal data holdings and ordering processes for orthoimagery, elevation, and other key data themes. Where preferred State provided data is not available, research the availability of these Federal data holdings.

FEMA / NSP Library – Review existing data in FEMA archives from most recent Pre-Scoping/Scoping package, MNUSS records, Community Assistant Contacts from CIS, etc.

Web Resources – Investigate local (County, Parish, Community) and regional (Council of Governments if applicable) web sites to find information about Geographic Information System (GIS) data available at the local level.

Federal Data Holdings

Federal Contacts – Contact the State representative for each major Federal data source to obtain the most up-to-date information on current status of data holdings and future projects. Share with them the most promising datasets you have identified in your research so far and ask whether they are aware of existing or planned data that might be better.

Data Coordination - Report any discovered inaccuracies or changes in information provided by the NSP Alexandria office back to the National Geospatial Data Coordinator (NGDC) for tracking by the GDCS team in Alexandria.

State Data Holdings

State Contacts – Following the State coordination procedures and the preferences indicated by the National States Geographic Information Council (NSGIC) representative in the NSGIC survey, contact the State representative to obtain the most up-to-date information on the current status of data holdings and future projects. Share with them the most promising datasets you have identified in your research so far and ask if they are aware of existing or planned data that might be better. Discuss your plans for coordination at the local or regional agency level. Obtain information regarding county/community level contacts if better information is available than the State provided in the NSGIC survey.

Data Coordination - Report any discovered inaccuracies or changes in contact information or the NSP Alexandria office data source back to the NGDC for tracking by the Data Standards Group in Alexandria.

STEP 3 - Identify Locally Available Data

Contact List – Document GIS contact information obtained through the State database, State Representative, FEMA archive search, and/or CIS system for inclusion in the Pre-Scoping report. Provide updates to the State NSGIC coordinator if requested.

County/Parish Contacts – Call GIS contact at the County/Parish and discuss local data holdings. Share with them the most promising datasets you have identified in your research so far and ask if they have preferred data for use in the Flood Insurance Study, and/or data that are more current or accurate than data available at the State/Federal level.

Community Contacts – Call GIS contact for incorporated communities in the Parish/County and discuss local data holdings. Share with them the most promising datasets you have identified in your research so far and ask if they have preferred data for use in the Flood Insurance Study, and/or data that are more current or accurate than data available at county/State/Federal level.

Data Coordination – Document data that may be used for the Flood Insurance Study and updated contact information for inclusion in the Pre-Scoping report.

3. Evaluating Existing Data

Chapter 2 focuses on evaluating the digital data that have been identified for potential use by FEMA mapping partners in accomplishing tasks related to Map Modernization. The primary base map and elevation data used for the project will have a significant impact on the accuracy level of the final products created.

3.1. Base Map Datasets

STEP 1 - Evaluate Community or Locally Supplied Data

Base map data that are supplied by communities or other non-Federal sources (e.g., State or regional agencies) and meet FEMA criteria are the first choice for DFIRM production. These files may be in either vector or raster format. If both are available, vector data are preferable due to the ease of their use, their file size, and their lower printing cost. However, community preferences are taken into account when making this choice.

STEP 2 - Evaluate Existing Base Map Datasets

For base map datasets to be used in place of Federal 1-meter DOQs for new DFIRM production, minimum standards must be met. These minimum standards are detailed in Section 1, Appendix A: Guidance for Aerial Mapping and Surveying and Appendix K: Format and Specifications for Flood Insurance Rate Maps of the G&S. The following items are critical items that must meet the required minimum standards for base map datasets:

Resolution – For raster data files 1-meter or better ground sample distance.

Horizontal Accuracy – NSSDA radial accuracy of 38 feet. While these are the DOQ specifications, the DOQs are generally more accurate than this, so be cautious of using data sets that approach the accuracy limit. For vector data sets without authoritative accuracy documentation, a review of the data set against the best available imagery should be performed to validate horizontal accuracy.

Distribution – FEMA must be able to redistribute the base map along with the DFIRM Database.

All new maps should be produced on the North American Datum 1983 Horizontal Datum.

STEP 3 - Evaluate Federal DOQs

Federally produced 1-meter DOQs are available for nearly the entire country and are the second choice and default base map if suitable community data are not available.

STEP 4 - Evaluate Other Sources or Options

If neither suitable community base map data nor Federal DOQs are available for a county scheduled for DFIRM production, an alternative strategy must be identified at the Scoping Meeting or the project should be postponed. If new imagery will be produced to provide the base map, it should be coordinated through the NDOP as discussed in Chapter 4.

3.2. Terrain Datasets

Guidance regarding the level of study versus the level of community risk is provided in Chapter 7 of the Multi-Year Flood Hazard Identification Plan (MHIP). A key component in determining the level of study is the accuracy of the terrain data.

For the highest risk areas, FEMA's G&S requires new terrain data production with a National Standard for Spatial Data Accuracy (NSSDA) vertical accuracy of 2.4 feet (Root Mean Square Error 1.2-feet), which is roughly equivalent to 4-foot contours using National Map Accuracy Standard (NMAS). In unusually flat areas, the project lead may determine that higher accuracy equivalent to 2-foot contours NMAS are required and authorize the additional expense. One of the primary reasons to perform new topographic mapping in high risk areas is to reduce the amount of

surveys for valley cross sections. Except under water or hydraulic structures, cross-section data can be derived from topographic data.

Where there are existing elevation data more detailed than the USGS quads, either in hard copy or digital format, the project should carefully evaluate whether these data will provide the required level of study for the area with more cost effectiveness than new data acquisition. Hardcopy 5-foot contour maps for a particular stream reach could be digitized and used for a study more cost effectively than producing new 4-foot contours and would produce very nearly the same level of result.

3.3. Record G&S Compliant Datasets in Scoping Tool

Record in the Scoping tool all discovered data sets that meet the accuracy requirements set forth in the G&S. This step should be part of both pre-scoping and scoping as data sets are identified.

Address each of the specific items listed below:

Accuracy – What is the horizontal/vertical accuracy of the data? How was the accuracy verified? Is the accuracy documented in the metadata?

Availability – Can this data be used/distributed by FEMA and FEMA Mapping Partners?

Cost – What is the cost for obtaining the data?

Coverage – What geographic area does the data cover?

Currency/Completeness – To what date does the data correspond to actual ground conditions? What features are included in the data, and are any relevant features not included?

Consistency – Is the representation, source, accuracy of features, the same throughout the dataset?

Naming – Are features named appropriately?

Creation – How was the data created?

Metadata – Does the data have metadata? If so, is the metadata Federal Geographic Data Committee (FGDC) compliant?

Resolution – For aerial photography what is the resolution of the data?

Source – What is the original source of the data, and where can the data be obtained?

Contact – What is the name, phone number, address, etc. of the person, agency, or department that needs to be contacted to obtain the data?

Report the final results of all steps by completing the Leverage Report and Obstacles report from Appendix I: Project Scoping Toolbox of the G&S. Include these reports in the Pre-Scoping deliverables.

4. Acquiring Existing Data

At the scoping meeting, the list of G&S compliant data discovered and documented by following the steps laid out in chapters 2 and 3 should be distributed to all of the stakeholders for evaluation and decision making. At the scoping meeting the stakeholders will determine if the data sets discovered meet the needs of the study requirements or if they will have to fund the development of new terrain or basemap information.

Chapter 4 focuses on acquiring digital data that are suitable for use by FEMA Mapping Partners in accomplishing tasks related to the Flood Map Modernization Program.

4.1. Obtain Best Available Data Identified

Step 1 - Request Data

Formally request the data that has been identified as suitable for inclusion in the Flood Insurance Study, from Federal, State, Regional, or local sources. Follow the data acquisition procedures, if any are identified, for each State or Federal Agency. Do not request data from individual contacts unless there is no centralized distribution system. Document any newly established and/or updated procedures for data acquisition and provide to The National Geospatial Data Coordinator in the NSP's Alexandria office.

When acquiring existing data for use in the development of the DFIRM, ensure that each distinct data set is accompanied by metadata that is FGDC compliant. Ensure that acquired data is available for FEMA to freely distribute as appropriate. FEMA must be able to distribute the base map data used for a study along with the DFIRM Database. If the base map data has distribution restrictions, it cannot be used. See G&S for specific options associated with basemap distribution.

STEP 2 - Perform Existing Data Checks

A check should be made of existing data that is acquired from government and local sources. This would involve looking for obvious blunders, edge matching problems and outliers.

Blunder check - involves looking at the attribute table of the digital data and sorting the elevation data to look for obvious outliers that are not consistent with the data.

Edge matching check - involves looking at the edges of tiles that are matched together to see if contours and elevation data are consistent from one tile to the next.

These types of checks can be performed and correction can be made to the data without going back to the source of the data. If problems are widespread in the data, then the source of the data should be contacted to discuss the problem. If the problem cannot be resolved, then an alternative source of data may have to be found for that particular mapping project or the level of study may have to be changed.

Responsibilities

It will be the responsibility of the Mapping Partner (CTP, IDIQ, OFA, RMC) doing the mapping project to perform the quality checks of the data to be used for their project. If FEMA is using one of its mapping contractors to perform the mapping project, that contractor is the one that must evaluate the existing data for usability in the mapping project.

4.2. STEP 3 - Document and Archive Data

Document locally supplied data in the NDOP and NDEP project coordination systems and load the data into the MIP with the required metadata as indicated in Chapter 6. Archive all locally obtained data with date, source, and other relevant information.

5. Acquiring New Data

Chapter 5 focuses on acquiring new digital data after the search for existing data sets has not resulted in the identification of suitable data for the project. During the Scoping Phase the project lead must determine if new data production is required to achieve the level of study required.

This policy was developed to cover the typical flood studies that FEMA performs. There may be special circumstances such as well-coordinated statewide or regional data production plans or unusual studies that may require some exceptions.

5.1. Topographic / Ground Elevation Data Policy

Overview

While many flood studies require new elevation data, this is only a component of an overall study process that is needed to update our flood data. FEMA is not able to support general-purpose data production and must focus our funds spent on elevation on the areas where we are updating our flood hazard analyses. When FEMA purchases elevation data, we generally only purchase the floodplain areas. For example, for a LIDAR collection, the vendor might fly a rectangular pattern over an entire watershed, but we would only task them to process the floodplain areas for a bare

earth model. Of course, we would prefer in this situation to find a partner to share the cost and produce the entire bare earth model since that has much greater overall utility. This is ultimately what we hope to achieve through successful partnerships under Map Mod.

There is emphasis on cost sharing from states and local governments for Map Mod. One major way that local governments will be able to provide a cost share without providing actual funding is to provide high quality elevation data. In the best case, a community or county may already have purchased this data and can get credit for cost sharing by making this data available to the flood study and for distribution. Another scenario is for the local jurisdiction to obtain new elevation data in conjunction with the flood study. While this would be a large expense, it will have many benefits for the community beyond the update of the flood maps. In either scenario, the credit for determining cost sharing would be based on the floodplain areas mapped, not the entire area for which the community collects elevation data. The amount of credit will also depend on whether the community is willing to freely share the data with other users as well. This cost sharing policy is already established in the CTP bluebook.

Policy

For any study, whether there is a community component or not, the process for funding ground elevation mapping should be as follows:

- FEMA will only fund finished bare earth elevation data in the floodplain, though collection of raw data (e.g., LIDAR) over the minimum rectangular area that contains the floodplains are located is acceptable if cost effective.
- FEMA will only fund minimum accuracy required for the study to be performed as outlined in FEMA's flood hazard mapping standards. This is determined on a reach-by-reach basis during scoping.
- FEMA will only fund data where acceptable data does not already exist, even if the data is not in a digital format unless it can be clearly demonstrated that new data collection is more cost effective.
- FEMA cost for ground elevation data and for the study must be proportionate to the risk for the area to be mapped.
- New elevation data produced must be referenced to North American Vertical Datum 1988.

5.2. Base Map Policy (Orthoimagery, Transportation and Hydrography)

Overview

Generally, the base map used for a flood map is not part of the flood risk assessment process. The base map is only used to display the results of the flood study in a usable way. As a result, the most important characteristic of the base map is that it is spatially accurate so that the features shown are in their correct real world locations. While important, it is not as critical that the base map be current. If ground conditions have changed substantially, then an older base map may cause too much confusion for users. However, where there have not been major changes, a spatially accurate, older base map is acceptable. Our current base map standard says that base maps must have been reviewed for update needs within the last seven years. This does not mean that base maps cannot be more than seven years old. Older base maps should be evaluated to determine if physical changes since the creation of the base map are sufficient to cause errors in the correct horizontal registration of floodplains depicted or to cause substantial confusion for map users.

In 1998 FEMA adopted a base map standard for new maps equivalent to the horizontal accuracy of the NDOP 1-meter DOQ. Where equal or higher accuracy data was not available locally, these data would be used as the base map for the flood maps. This was intended to insure that the digital flood data would be registered accurately enough to be used in a GIS. It is critical that all modernized products use a base map that meets this accuracy standard and the base map can be distributed freely by FEMA.

The minimum accuracy standard for the DOQs is ± 33 -feet based on the old NMAS. In practice they are generally much more accurate, closer to ± 20 -feet. Given the precision possible with Hydrologic & Hydraulic modeling techniques, this accuracy should be sufficient for nearly all flood mapping applications.

Policy

For a study the process for funding base maps should be as follows:

- FEMA will only provide funding when existing base maps are inadequate. FEMA will provide leverage credit if adequate maps exist, but community supplies better maps.
- Base maps must be distributable by FEMA without restriction or cost
- FEMA will only provide maximum of 50% of the NDOP cost for base maps for a community project.

5.3. Types, Accuracy and Area of Applicability of Available Terrain Datasets

Currently the methods for obtaining terrain datasets is traditional photogrammetry; digital camera photogrammetry (multi-angle scanning with a high resolution stereo camera {ISTAR}); Light Detection and Ranging (LIDAR); radar (Interferometric Synthetic Aperture Radar {IFSAR}; Shuttle Radar Topography Mission {SRTM}) and Geographic Synthetic Aperture Radar (GeoSAR). Depending on the vendor and their business model, some data may have use or distribution restrictions.

Below is a table that compares the type of terrain dataset acquisition to the accuracy and applicability of each collection method. This information can be used to help make a decision on what accuracy of new terrain is needed for the level/type of flood hazard study that is to be performed for the project area.

Table 1 Terrain Dataset Comparison

Type of Terrain Dataset	Maximum Possible Vertical Accuracy of Dataset (is this NSSDA accuracy or RMSE. Should be consistent)	Area of Applicability
Photogrammetry	1-2-feet should be in meters	All terrain types
LIDAR	+ 0.20-meters	All terrain types
IFSAR	1-3-meters	Open, Non-vegetated
ISTAR	2.5-meters	Open, Non-vegetated
GeoSAR	1-4-meters	All terrain types
SRTM	+ 10-meters	Open, Non-vegetated

6. Building partnerships for the Creation of New Data

Chapter 6 focuses on building partnerships for the production of new geospatial data. Because there are generally many uses for elevation or imagery data, it is frequently possible to find partners interested in funding part of a project or funding an addition to a project that increases the benefits of the project.

6.1. Identify Existing Partners and Potential Partners

Publish Information about the Planned Project

As soon as the need for new data production is identified, add or update the published information in the NDEP or NDOP immediately. This will automatically update the Geospatial One Stop as well. Provide as much specific information about the project as possible. The goal is to publish this information as far in advance of the start of the production as possible to facilitate partnering. For details see Chapter 7.

Search for Similar Planned Projects

Depending on whether the project is for elevation or imagery data production, use the NDEP or NDOP tracking system to look for projects with compatible requirements. If any are identified, work with the contact identified to see if a joint project is possible.

Contact the State representative for each major Federal agency, the State NSGIC representative, regional agencies, and local contacts to identify any who might be interested in partnering on data production.

Build Partnership Agreements

If no prior partnership agreement is in place, work with potential Federal, State, and local partners to build a partnership arrangement for the acquisition or creation of the new data. Ensure that a partnership agreement allows FEMA to publicly distribute the data as appropriate.

Treat geospatial data created during a flood study as a separate deliverable. Make sure it complies with G&S, is documented by robust metadata, and a copy is delivered to FEMA and the MIP.

7. Document Data

7.1. Post Planned Projects to Appropriate Systems

In order to comply with Federal requirements, planned production must be posted to appropriate systems. This process must initially be coordinated closely with the National Geospatial Data Coordinator in the NSP's Alexandria office and will become more automated with future versions of the MIP.

The MIP is a registered National Spatial Data Infrastructure node. Once the Imagery and Elevation Registry and the Multi-Hazard Data Catalog are available, any metadata record included in those systems will be discoverable by the GOS. This capability will broadcast to the geospatial community the planned FEMA data development projects as well as FEMA's spatial data holding.

STEP 1 - Post Planned FEMA Project Areas to GOS

The GOS portal is an intergovernmental project managed by the Department of the Interior in support of the President's Initiative for E-government. Its goals are to improve the ability of the public and government to use geospatial information to support the business of government and facilitate decision-making by providing access to searching all types of geospatial data production. Federal Agencies are required to publish planned and completed mapping projects to this site.

In order to meet this requirement, Baker Alexandria will post, maintain and remove records for all Map Modernization projects on the GOS. Projects that will produce geospatial data will be posted and maintained on the MIP Hazard Catalog for harvesting by the GOS portal. The initial posting for each project shall be accomplished by January 31st of the fiscal year prior to the year when the project will be initiated. These records will identify the geospatial coordinator at each RMC as the point of contact for this project. If a Region prefers to have a FEMA contact listed, they can contact Baker Alexandria. The general project record posted to the Hazard Catalog will be removed when the DFIRM project is completed. By that point in time, all of the completed spatial components of the project will already be posted in the appropriate metadata catalogs for discovery by the GOS. Identifying project areas and sharing this information with potential partners early on is critical to good coordination. The geospatial data for projects that have been completed and are not currently on GOS will also be posted on the MIP Hazard Catalog.

STEP 2 - Post Elevation to NDEP and Orthoimagery to NDOP

The NDEP is a multi-agency program that was established to promote the exchange of accurate digital land elevation data among government, private, and non-profit sectors and the academic community. The NDOP was chartered in 1993 as a consortium of Federal agencies with the purpose of developing and maintaining national orthoimagery coverage in the public domain by establishing partnerships with Federal, State, local, tribal, and private organizations.

Following a scoping meeting, the RMC staff will enter any planned elevation or orthophoto data development projects into the NDOP and NDEP project tracking systems on the MIP. They will also post information about locally obtained elevation and orthoimagery. There is an entry screen on the tracking system for entering these projects. These records will then be pushed to the NDEP and NDOP project tracking catalogs to focus on their respective user communities. Projects entered into the tracking systems will automatically appear in the GOS marketplace as well.

STEP 3 - Post Metadata Records of Completed Spatial Projects

The Data Capture Standards will require each key geospatial dataset to include metadata when it is submitted to the MIP. As long as the DCS / MIP metadata requirements are met, Baker Alexandria will insure that the metadata for the completed project is posted to the GOS and any related records for the planned project are removed. As each spatial component of a DFIRM project is completed and accepted as a deliverable on the MIP, its metadata record will be pushed into the appropriate catalog for discovery by the GOS or inclusion/update on the NDEP and NDOP sites. Planned elevation and ortho projects will be updated to completed projects in the NDOP and NDEP tracking systems, and completed intermediate data submissions will be posted to the Multi-Hazard Data Catalog. When a DFIRM is completed and accepted, its metadata record will also be pushed into the Multi-Hazard Data Catalog for discovery by the GOS. At that point in time, the original planned FEMA project record that was pushed into the Multi-Hazard Data Catalog prior to the project scoping phase will be removed. All spatial components of that planned project are at that point now published in or discoverable by the appropriate Federal metadata catalogs.

Appendix A. Contact Information

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